failed, although he was able to determine that a tumor placed within the cranium upon the brain was very distinctly noticed.

Pancoast and McCarthy conclude that the value of the Roentgen rays in brain lesions is at present dubious.[1]

In addition to the tumors and cases of softening, I have had a case in which the skiagraph seemed to show thickening of the membranes to a considerable extent. This corresponded to the clinical symptoms. No autopsy has been obtained, and, therefore, I can draw no definite conclusion.

In conclusion, I believe that we should be able to show in the skiagraph most large lesions, such as new-growths, softening, hemorrhage, and abscess; but I want to repeat what I said at our meeting a year ago, when discussing this subject, "I would never take the responsibility of an operation upon the brain purely upon skiagraphic evidence.

"On the other hand, all of the above cases should be examined by the *x*-ray, with the idea of confirming or adding to the clinical evidence."

ON THE PRESENCE OF ORGANIC ACID IN THE URINE IN CASES OF RHEUMATOID ARTHRITIS.

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While rheumatoid arthritis presents such marked and distinctive pathological features, its etiology and the primary seat of the affection are still unknown. Because of this the study of the metabolic changes taking place in the course of the disease becomes of especial interest, and any observation seemingly of small moment may prove of real value in helping to determine the cause of the morbid condition.

It is with this in view that the following observations are recorded, relating to the presence of an organic acid in the urine of patients suffering from this disease.

From the time of the first examinations of urinary sediment with the microscope, the presence of certain organic acids in the urine has been recognized. Uric acid, oxalic acid, and hippuric acid, by their precipitation under morbid conditions, have been forced upon the attention of pathologists, and in the study of methods for their estimation it was early found that they were present in the urine in solution even when not found in the sediment. It was not, however, until the study of acid intoxications by Gaethgens,[1] Walter,[2] Salkowski,[3] and later others, as Stadelmann[4] and Magnus-Levy,[5] that methods were discovered for detecting organic acid in the urine and approximately estimating the amount present even when the nature of the acid was not known.

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[1] *University of Pennsylvania Medical Bulletin*, March, 1903.

The method employed by Magnus-Levy[6] in determining the amount of β-oxybutyric acid excreted in diabetes is the one which has been used in making the following observations. This method is based upon the fact which has become well established that acids are excreted from the kidneys, not as free acids, but only in combination with bases to form salts. This being the case, if all the acids and bases present in the urine are estimated and represented in terms of their chemical equivalents, with reference to the same substance as sodium, the total acid present will be found to exactly balance the sum of the bases. Gaethgens, Hagentorn, and Magnus-Levy found that when the known acid and basic constituents present in appreciable quantities in normal urine were thus estimated, the acids and bases did almost exactly balance each other. There was, however, uniformly present a slight excess of acids over the bases determined, and this was considered to be balanced by organic bases such as the purin bodies, which had not been estimated. Estimations were made of potassium oxide, sodium oxide, calcium oxide, magnesium oxide, and ammonia, and of hydrochloric acid, uric acid, preformed sulphuric acid, combined sulphuric acid, monobasic phosphoric acid, and dibasic phosphoric acid.[7]

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[1] Zur Frage der Ausscheidung freier Säuren durch den Harn. Med. Centralbl., 1872, S. 833. Ueber Ammoniakausscheidung, Zeitschr. f. physiolog. Chemie, Bd. iv. S. 35.

[2] Untersuchungen über die Wirkung der Säuren auf den thierischen Organismus, Archiv f. experiment. Pathol. u. Pharmakol., 1877, Bd. vii. S. 148.

[3] Ueber die Möglichkeit der Alkalienziehung am lebenden Thiere, Virchow's Archiv, 58, S. 1.

[4] Ueber den Einfluss der Alkalien, u. s. w., Stuttgart, 1890, S. 122 ff. bei Hagentorn.

[5] Die Oxybuttersäure und ihre Beziehungen zum Coma diabeticum, Archiv f. experiment. Pathol. u. Pharmakol., 1899, Bd. xlii. S. 149. Untersuchungen über die Acidosis im Diabetes mellitus und die Saureintoxication im Coma diabeticum, Archiv f. experiment. Pathol. u Pharmakol., 1900-1901, Bk. xlv. S. 388.

[6] For a detailed discussion of this method reference is made to Magnus-Levy's article, loc. cit.

[7] The following methods were employed in estimating the acids and bases. (See Neubauer und Vogel's Harnanalyse.)

Potassium and sodium by Lehmann's method. Separation by indirect volumetric method.
Calcium oxide, by precipitating as CaC_2O_4 and weighing as CaO.
MgO, by precipitating as NH_4MgPO_4 and weighing as $Mg_2P_2O_7$.
NH_3, by Schlösing's method.
SO_3 preformed and SO_3 combined, by Salkowski's gravimetric method.
P_2O_5 total, by Neubauer's volumetric method.
P_2O_5 dibasic and monobasic, by Freund's method.
Cl, by Mohr's method.
Uric acid, volumetrically by Folin's method. Zeitschr. f. physiolog. Chemie., Bd. xxxii. S. 514.

The following cases from our records illustrate the balancing of acids and bases in twenty-four-hour specimens of normal urine.[1] The weights are given in the sodium equivalent of each acid or base (Table I.):

TABLE I.

Case	I.	II.	III.	IV.	V.	VI.	VII.	VIII.	IX.	X.
K_2O	2.525	1.547	2.5720	1.0470	0.7286	1.2840	0.9232	1.6360	2.3740	0.9757
Na_2O	2.001	4.249	5.2250	2.4040	1.3300	2.1090	3.881	3.7040	4.0930	1.2970
CaO	0.2165	0.476	0.2289	0.0126	0.0768	0.0722	0.2154	0.2319	0.0952	0.0307
MgO	0.1439	0.268	0.1302	0.1298	0.0664	0.1757	0.0806	0.1733	0.2237	0.1098
$N(H_3)$	0.6127	1.398	1.3910	0.3136	0.2859	0.4561	0.4704	1.5430	1.0930	0.5181
Total bases	5.4991	7.938	9.5471	3.9070	2.4877	4.0970	5.5706	7.2882	7.8789	2.9313
SO_3 preformed	0.9051	1.420	1.5390	0.5584	0.4709	0.7078	0.9734	1.4500	1.2880	0.6570
SO_3 combined	0.0465	0.073	0.1347	0.0219	0.0150	0.0167	0.0356	0.0564	0.0663	0.0243
P_2O_5 dibasic	1.300	0.782	1.1930	0.5864	0.4808	3.0730	0.7432	0.8680	0.7387	0.4212
P_2O_5 monobasic	0.0849	0.601	0.3023	0.0408	0.0548	0.0364	0.1987	0.3715	0.2916	0.2106
Cl	3.171	5.386	6.9720	2.8280	1.5180	0.5994	4.476	4.5910	5.4130	1.6360
Uric acid	0.0432	0.117	0.0894	0.0221	0.0143	0.0930	0.0584	0.0911	0.0870	0.0431
Total acids	5.5507	8.379	10.2304	4.0576	2.5538	4.5263	6.4853	7.4280	7.8846	2.9922
Apparent excess of acids balanced by organic bases	0.0516	0.441	0.6833	0.1506	0.0661	0.4293	0.9147	0.1398	0.0057	0.0609

If, now, an acid is excreted in the urine other than those ordinarily found its presence can be detected in estimating the acids and bases, for in this case there will be an excess of bases over the acids normally present, the excess being required to neutralize this acid, which is not normally excreted. This may be illustrated by a twenty-four-hour specimen of urine from a case of diabetes mellitus. The patient had 5 per cent. of sugar in the urine.

The analysis is as follows, the weights as before being in equivalent weights of sodium:

K_2O	5.0070 grms.	SO_3 preformed	1.5950 grms.
Na_2O	6.5030	SO_3 combined	0.0666
CaO	0.2051	P_2O_5 dibasic	2.0160
MgO	0.3910	P_2O_5 monobasic	0.5054
$N(H_3)$	1.7120	Uric acid	0.1719
		Cl	6.5030
Total bases	13.8181	Total acids	10.8579

The excess of bases over the acids estimated in this case is 2.9602 grams, or 21 per cent. of the total bases; that is, the amount of organic acid present (in this case known to be chiefly β-oxybutyric acid) is that which will combine with 2.96 grams of sodium.

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[1] It is, of course, necessary to use the greatest care in preventing any decomposition of the specimens, since the conversion of urea into ammonium carbonate will invalidate the result. The separate portions of urine should be thoroughly shaken with carbolic acid, chloroform, or thymol before any bacterial action can begin.

It is also evident that if any organic acid, as salicylic acid or the salicylates, were administered at the time of the observations, it would be estimated with the other organic acid excreted.

Magnus-Levy used this method chiefly in estimating the amount of organic acid present in diabetic urine. He mentions, however, that organic acid is in this way found to be present in lesser amounts in other conditions, such as starvation, intestinal disturbance, phosphorus poisoning, acute yellow atrophy, and fever. Herter and Wakeman,[1] using Magnus-Levy's method of analysis, reported the finding of organic acid in the urine in cases of dilatation of the stomach, with atony, rheumatoid arthritis, and cirrhosis of the liver.

Since in the cases of rheumatoid arthritis reported by Dr. Herter there was found organic acid in the urine other than that normally present, it has seemed well to continue this investigation. I have, therefore, estimated the acids and bases in the urine in all cases of this kind as patients happened to come under observation.

The following records include reports of forty specimens of urine from twenty-one different patients. In all cases in which the disease was progressing—that is, in thirty-three of the specimens—there was found to be an excess of the bases over the acids normally present, thus indicating the presence of organic acid. The remaining seven specimens were from patients in whom the symptoms were stationary or improving, and in these the analysis showed a normal condition—that is, with the estimated acids slightly in excess of the bases.

In studying these records it should always be borne in mind that an apparent excess of bases indicates the presence of a corresponding amount of some acid not normally present in the urine, and so not estimated.

Case I.—An illustrative case may be reported in detail.[2] The patient was a young woman who for several years had been suffering from rheumatoid arthritis. Both ankles, both knees, both wrists, and the small joints of the hands were involved, with swelling, tenderness, pain, deformity, and impairment of motion. At the time that the first analyses were made the disease was steadily progressing. The results of the urinary analysis were as follows:

October 26, 1899.	K_2O	1.3370	SO_3 preformed	0.9961
	Na_2O	3.9780	SO_3 combined	0.0388
	CaO	0.1345	P_2O_5 dibasic	0.6725
	MgO	0.1861	P_2O_5 monobasic	0.1400
	$N(H_3)$	0.9663	Uric acid	0.0868
			Cl	3.8830
	Total bases	6.6019	Total acids	5.8172

Excess of bases 0.7847, or 11.9 per cent. of total bases.

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[1] Notes on Acid Intoxications. Proceedings of New York Pathological Society, 1900–1901. C. A. Herter. The Pathology of Acid Intoxications. Transactions of the Association of American Physicians, vol. xv.

[2] Only a brief summary of the condition of these cases is given, since the question as to whether the disease is progressive or stationary seems to be the one determining whether or not the abnormal acid is present in the urine.

27th. Total bases, 4.7823; total acids, 4.6475; excess of bases, 0.1348; 2.8 per cent. of total bases.

28th. Total bases, 7.9051; total acids, 7.2755; excess of bases, 0.6296; 7.8 per cent. of total bases.

January 20, 1900. Total bases, 5.7926; total acids, 5.1932; excess of bases, 0.5994; 10.3 per cent. of total bases.

At this time the stomach contents were examined, and there was found to be no hydrochloric acid present after a test meal, although there had been no gastric symptoms. Lavage was used about twice a week for the next ten months. At first the stomach contents were always fermented and contained fatty acids, but after routine washings for several months hydrochloric acid was found in the stomach after a test meal.

Urinary Examination. February 14, 1900. Total bases, 6.7765; total acids, 6.1873; excess of bases, 0.5892; 8.7 per cent. of total bases.

April 4th. Total bases, 6.8089; total acids, 6.3930; excess of bases, 0.4159; 6.1 per cent. of total bases.

May 14th. Total bases, 7.2896; total acids, 6.9305; excess of bases, 0.3591; 4.9 per cent. of total bases.

The patient spent the winter of 1900 and 1901 in California, living in the open air and exercising on horseback, with no other treatment. The next analysis was after a year's interval

May 14, 1901. Total bases, 8.0026; total acids, 8.1500; excess of *acids*, 0.1474. At this time the symptoms were all in abeyance. There remained some deformity of the joints and some weakness in the muscles, but the disease was for the time arrested in its course.

Case II.—Another case in which the amount of the abnormal acid was diminished in the urine, with an improvement in the other symptoms, is the following:

The patient was a working girl who had for several years been suffering from increasingly severe symptoms in the joints of the wrists, fingers, knees, and ankles, with characteristic deformities in the joints. She could no longer work, and she could with difficulty walk about.

The stomach contents were examined after a test meal, and there was absence of hydrochloric acid.

Urinary Analysis, February 19, 1900. Total bases, 5.0916; total acids, 4.4570; excess of bases, 0.6346; 12.4 per cent. of total bases.

The patient spent the eight months following this examination under as favorable hygienic surroundings as were possible for a person of small means.

She took hydrochloric acid after meals throughout this time. She markedly improved in health, and became able to use her hands and feet, with but little discomfort.

Urinalysis, November 8, 1900. Total bases, 4.3337; total acids, 4.1108; excess of bases, 0.2229; 5.1 per cent. of total bases.

CASE III.—Another patient showing an improvement in symptoms which was not as marked as in the case of those cited above was the following: On May 24, 1900, the patient was first seen. She then complained of pain in the shoulders, knees, and soles of the feet, with deformity of the hands. Two years before the patient had begun to have severe pain in the hands, extending to the arms. She was unable to sleep on account of the pain, and often walked the floor at night. Then pain developed in the soles of the feet, in the knees, and in the legs. Not until a year later did the joint swelling in the hands begin. There was steadily increasing disability from this time. On examination the hands were found to be in a position of extension and ulnar deflection. Flexion is much limited, extension nearly complete. The lower ends of the ulnar bones are very conspicuous and bulbous. The carpometacarpal joints of the hands are most involved. The right knee is swollen, and there is apparently extra-articular thickening. Extension of this knee is painful. The left knee is not swollen, but is painful on motion. There is no joint deformity in the foot except hallux valgus.

June 7, 1900. The stomach contents, examined after a test meal, showed absence of hydrochloric acid. Total bases in the urine, 5.5391; total acids, 4.4402; excess of bases, 1.0989; 19.8 per cent. of total bases.

The patient improved slowly throughout the summer, but still had a good deal of tenderness in the affected joints when the next examination was made.

December 14*th*. Total bases, 3.0073; total acids, 2.9989; excess of bases, 0.0084; 0.28 per cent. of total bases.

CASE IV.—The following record is that of a patient who was first seen in an interval when she was having no active symptoms. Three years before this she had had rapidly developing symptoms from the disease, with involvement of the knees, ankles, elbows, wrists, and the metacarpophalangeal joints of both hands. At the time when the first urinary examination was made she had remaining some deformity of the joints in the hands, with limitation of motion in the right wrist and left ankle. The urine was at this time normal as regards the balancing of acids and bases. Total bases, 5.0979; total acids, 5.2541; excess of *acid*, 0.1562. Two years after this there was an exacerbation of the symptoms, brought on by exposure to cold. All the joints involved were affected, with very severe pain in the knees on standing and rapid atrophy and loss of power in the muscles. Total bases in twenty-four-hour specimen, 7.9067; total acids, 7.6305; excess of *bases*, 0.2762; 3.5 per cent. of total bases. Five months later, when the acute symptoms were again subsiding, the urine was again normal. Total bases, 4.7278; total acids, 5.1523; excess of *acid*, 0.4245.

The following records are from fifteen cases in which the disease was progressing. It will be noted that in all of these there is an excess of bases over the acids estimated (Table II.):

TABLE II.

	Case V.			Case VI.				Case VII.		Case VIII.	
	Nov. 12, 1900	Dec., 1900	Jan. 31, 1901	Jan. 26, 1900	Jan. 31, 1900	Feb. 21, 1901	1901	Jan. 10, 1900	Apr. 30, 1900	Feb. 11, 1902	Jan. 17, 1903
K_2O	1.1060	0.8600	1.0340	1.027	0.8367	0.9879	0.6258	2.651	2.1200	0.7816	0.5119
Na_2O . . .	2.2730	2.2472	2.4010	1.136	1.2730	0.8217	0.8453	1.013	0.4369	1.992	1.413
CaO	0.1232	0.1290	0.0709	0.1227	0.1039	0.1035	0.1070	0.0605	0.2032	0.0613	0.0821
MgO. . . .	0.1915	0.0753	0.0524	0.0350	0.0751	0.0764	0.0903	0.1496	0.1151	0.0814	0.0232
$N(H_3)$ . . .	0.4816	0.6272	0.3238	0.6516	0.2541	0.4374	0.2462	0.5401	0.5967	1.298	0.6105
Total bases . .	4.1753	3.9387	3.8811	2.9723	2.5428	2.4269	1.9146	4.4142	3.4719	4.2143	2.6407
SO_3 preformed .	0.4061	0.4949	0.1644	0.4239	0.3238	0.5624	0.3434	0.7177	0.5333	0.6798	0.5501
SO_3 combined .	0.0373	0.0335	0.0310	0.0275	0.0305	0.0526	0.0452	0.0600	0.0278	0.0443	0.0455
P_2O_5 dibasic . .	0.4652	0.4017	0.3889	0.5459	0.1936	0.3286	0.2333	0.6385	0.1313	0.6125	0.9298
P_2O_5 monobasic .	0.0259	0.1653	0.0583	0.0428	0.1571	0.2456	0.1846	0.0339	0.1804	0.1531	0.0211
Uric acid . . .	0.0630	0.0420	0.0389	0.0472	0.0303	0.0372	0.0281	0.0433	0.0389	0.0257	0.0821
Cl	2.6180	2.123	2.5540	1.581	1.4870	0.9817	0.8962	2.8000	3.4620	1.954	0.8847
Total acids . .	3.6155	3.2604	3.2355	2.6683	2.2223	2.2081	1.7308	4.2934	3.3737	3.4694	2.5133
Excess of bases .	0.5598	0.6783	0.6456	0.304	0.3205	0.2188	0.1838	0.1208	0.0982	0.7449	0.1274
Per cent. of excess .	13.4	17.2	16.6	10.2	12.6	9.02	9.6	2.7	2.8	17.6	4.8

	Case IX.	Case X.	Case XI.	Case XII.	Case XIII.	Case XIV.	Case XV.	Case XVI.	Case XVII.	Case XVIII.	Case XIX.
K_2O	1.3550	1.3385	0.6175	0.7256	1.485	1.558	0.6947	0.9694	0.5495	1.2690	0.8768
Na_2O . . .	3.4010	2.3930	0.9828	3.043	1.088	2.862	4.116	0.8768	3.299	2.1780	1.8980
CaO	0.1184	0.2412	0.2241	0.0634	0.0354	0.2558	0.0952	0.0768	0.1429	0.0965	0.0843
MgO	0.0885	0.1430	0 0746	0.1306	0.1144	0.2125	0.1312	0.0343	0.1432	0.1199	0.1044
$N(H_3)$ . . .	1.0440	1.0875	0.5753	0.9131	1.121	1.016	0.2669	0.3861	1.154	0.2226	0.4651
Total bases . .	6.0069	5.2032	2.4743	4.8757	3.8438	5.9043	5.3040	2.3434	5.2886	3.8860	3.4286
SO_3 preformed .	0.6033	0.4935	0.5315	0.6656	0.7519	0.7794	0.2662	0.2433	0.7039	0.4888	0.3082
SO_3 combined .	0.0757	0.0463	0.0390	0.0495	0.0372	0.0460	0.0380	0.0409	0.0563	0.0344	0.0321
P_2O_5 dibasic . .	0.6545	0.6740	0.2522	0.8435	0.6415	1.096	0.5834	0.3796	0.6834	0.6674	0.8035
P_2O_5 monobasic .	0.0123	0.0114	0.0074	0.1061	0.1040	0.1801	0.0436	0.0000	0.3095	0.0453	0.0917
Uric acid . . .	0.0586	0.0541	0.0586	0.0456	0.0407	0.0635	0.0391	0.0743	0.2336	0.0090	0.0193
Cl.	3.8780	3.1405	1.0420	3.038	2.129	3.407	3.256	0.7676	3.126	2.1630	1.9110
Total acids . .	5.2824	4.4198	1.9307	4.7483	3.7043	5.5720	4.2263	1.5057	5.1127	3.4079	3.1658
Excess of bases .	0.7245	0.7834	0.5436	0.1274	0.1395	0.3323	1.0777	0.8377	0.1759	0.4781	0.2628
Per cent. of excess .	12.1	15	22	2.6	3.6	5.6	20.3	35	3.3	12.3	7.6

Case XVI., which shows the largest amount of organic acid, is that of a very marked case of arthritis deformans in which there was almost complete ankylosis of all the joints. The specimen was examined a few weeks before the patient's death. The urine was alkaline, but showed no evidences of decomposition.

In the two remaining cases, in each of which only a single urinary examination was made, the disease had become stationary. So while there was much disability and rigidity of the joints, the disease was not progressive. The following records are from these patients (Table III.):

TABLE III.

	Case XX.	Case XXI.
K_2O	0.8461	0.6823
Na_2O	1.489	4.625
CaO	0.1138	0.4042
MgO	0.1695	0.1491
$N(H_3)$	0.6114	1.221
Total bases	3.2298	7 0816
SO_3 preformed	0.5099	1.261
SO_3 combined	0.353	0.0702
P_2O_5 diabasic	0.6234	0 2159
P_2O_5 monobasic	0.1266	0 7511
Cl	1.904	4.865
Uric acid	0.0421	0 0196
Total acids	3.2413	7.1828
Excess of acid.	0.0115	0.1012

ON THE OCCURRENCE OF INTESTINAL PUTREFACTION IN RHEUMATOID ARTHRITIS. While the analyses of these specimens of urine were made primarily to determine the relative amount of acids and bases present, there are certain other points of interest with reference to these cases.

Since the work of Baumann it has been recognized that the amount of intestinal putrefaction can be approximately measured by the ratio of the aromatic sulphates to the simple (preformed) sulphates excreted in the urine. Certain aromatic products of intestinal putrefaction, as indol, skatol, and phenol, become linked in the body with sulphuric acid to form the so-called ethereal or aromatic sulphates. Normally these bear a ratio to the simple preformed sulphates of from 1:10 to 1:15, but in cases of intestinal putrefaction the ratio increases to 1:8 or 1:5, or even in exceptional cases, so that the amount of aromatic sulphates is equal to that of the preformed sulphates.

In certain cases of intestinal putrefaction, however, one of these aromatic products may be formed in excess, while the total aromatic sulphates will not be above the normal. Thus the presence of indican in the urine, indicating the formation of indol by a putrefactive process, may be noted in a given case in which the total ethereal sulphates are in normal amount, or the reverse may be true, that indican may be entirely absent from the urine while the formation of other products of putrefaction leads to an excess of aromatic sulphates. In all but two of the cases of rheumatoid arthritis noted above, in which the disease was progressing, there was found either an excess of aromatic sulphates in the urine or else the presence of indican, and these two were mild cases.

In twenty-three specimens there was an increase in the aromatic sulphates excreted, the ratio varying from 1:2.6 to 1:9.8, the average being 1:6.2 (Table IV.):

TABLE IV.

	Case II.		Case III.		Case IV.			Case V.		
	Feb. 19, 1900.	Nov. 8, 1900, improved.	June 7, 1900.	Dec. 14, 1900 improved.	Nov. 15, 1900, no active symptoms.	July 5, 1902, exacerbation.	Nov. 23, 1902, improved.	Nov. 12, 1900,	Dec., 1900.	Jan. 31, 1900.
Volume . . .	1260	740	1400	567	1040	1500	980	1080	900	1120
Specific gravity .	1017	1026	1013	1023	1020	1021	1024	1015	1016	1011
Reaction . .	acid	st'ngly acid	acid	acid	st'ngly acid	acid	st'ngly acid	sl'ghly acid	acid	sl'ghly acid
Albumin . .	0	0	0	0	0	0	0	0	0	0
Indican . . .	0	...	...	0	0	0	0	...	0	present
Urea . . .	20.03	16.42	22.48	12.17	26.92	33.06	23.4	12.27	14.19	9.85
Uric acid . .	0.1955	0.4047	0.2072	0.219	0.5618	0.9214	0.5373	0.460	0.3063	0.283
Ratio $\frac{\text{urea}}{\text{uric acid}}$.	102	41	108	55	48	36	44	27	46	35
H_2SO_4 preformed .	1.7151	1.6063	1.260	1.047	2.068	2.858	1.647	0.865	1.0557	0.350
H_2SO_4 combined .	0.1929	0.1307	0.1390	0.083	0.1922	0.2145	0.15	0.158	0.1423	0.132
Ratio $\frac{H_2SO_4\ p}{H_2SO_4\ c}$.	8.88	12.28	9.06	12.6	10.8	13.3	10.8	5.5	7.4	2.65
Total N . . .	9.358	7.670	10.51	5.69	12.57	15.42	10.93	5.73	6.627	4.6
N of NH_3 grms. .	0.5509	0.4184	0.4387	0.46	0.5025	0.5672	0.3986	0.29	0.3818	0.196
N of NH_3 (per ct. of total N) .	5.9	5.5	4.1	8.1	4	3.6	3.6	5	5.8	4.3

	Case VI.				Case VII.		Case VIII.		Case IX.	Case X.
	Jan. 26, 1900.	Jan. 31, 1900.	Feb. 21, 1901,	Mar. 4, 1901.	Jan. 10, 1900.	Apr. 30, 1900.	Feb. 11, 1902.	Jan 17, 1903.		
Volume . . .	600	570	700	530	2095	1815	1120	1250	1335	1033
Specific gravity .	1023	1019	1020	1018	1012	1010	......	1011	1016	1018
Reaction . .	alkaline	acid	acid	sl'ghly acid	alkaline	acid	sl'ghly acid	acid	sl'ghly acid	sl'ghly acid
Albumin . .	0	0	0	0	0	0	present	large am'nt	0	0
Indican . . .	0	0	slight	very slight	slight	0	0	0	0	0
Urea . . .	11.55	10.52	17.46	11.33	16.63	10.67	19.80	16.79	16.3	12.29
Uric acid . .	0.3445	0.221	0.272	0.205	0.3163	0.2841	0.1972	0.7210	0.428	0.40
Ratio $\frac{\text{urea}}{\text{uric acid}}$.	34	48	64	55	53	37	100	23	38	31
H_2SO_4 preformed .	0.8847	0.676	1.20	0.731	1.498	1.113	1.4476	1.199	1.26	0.98
H_2SO_4 combined .	0.1146	0.127	0.224	0.192	0.2681	0.1158	0.1884	0.1935	0.316	0.193
Ratio $\frac{H_2SO_4\ p}{H_2SO_4\ c}$.	7.7	5.3	5.4	3.8	5.6	9.6	7.69	6.2	4.0	5.1
Total N . . .	5.4	4.92	8.15	5.30	7.771	4.985	9.251	7.832	7.73	5.74
N of NH_3 grms. .	0.3967	0.155	0.266	0.15	0.3287	0.3632	0.7920	3.3716	6.35	0.66
N of NH_3 (per ct. of total N) .	7.4	3.2	3.3	2.8	4.2	7.2	8.6	4.8	8.2	11.5

TABLE IV.—Continued.

	Case XI.	Case XII.	Case XIII.	Case XIV.	Case XV.	Case XVI	Case XVII.	Case XVIII.	Case XIX.
Volume . . .	650	840	950	950	1035	465	1500	1375	1400
Specific gravity .	1018	1021	1014	1021	1014	1029	2018	1011	1008
Reaction . .	acid	acid	acid	acid	acid	alkaline	str'ngly acid	acid	slightly acid
Albumin . .	slight	0	0	0	0	0	0	0	faint trace
Indican . . .	moderate	0	0	0	0	0	faint trace		
Urea . . .	14.47	16.28	18.94	22.53	9.396	14.35	20.78	12.71	9.91
Uric acid . .	0.428	0.3326	0.2971	0.4639	0.2851	0.54	1.706	0.066	0.141
Ratio $\frac{\text{urea}}{\text{uric acid}}$.	35	49	64	48	33	26.5	12	193	70
H_2SO_4 preformed .	1.13	1.4175	1.602	1.6272	0.5555	0.849	1.4993	1.02	0.643
H_2SO_4 combined .	0.166	0.2105	0.1470	0.1918	0.1584	0.170	0.2397	0.143	0.134
Ratio $\frac{H_2SO_4\ p}{H_2SO_4\ c}$.	6.8	6.7	10.9	8.5	3.5	4.98	6.26	7.12	4.8
Total N . . .	6.76	7.602	8.843	10.53	4.384	6.71	9.709	5.94	4.63
N of NH_3 grms. .	0.35	0.5687	0.6824	6.6184	0.1625	0.235	0.7025	0.14	0.28
N of NH_3 (per ct. of total N) .	5.2	7.5	7.7	5.9	3.7	3.5	7.2	2.28	6

In Case I. the aromatic sulphates were not increased, but indican was present in every specimen examined (Table V.):

TABLE V.

	Case I.								
	Oct. 26, 1899	Oct. 27, 1899	Oct. 28, 1899	Jan. 20, 1900	Feb. 14, 1900	April 4, 1900	May 14, 1900	May 14, 1901	May 16, 1901
Volume (c.c.) .	1130	810	1175	1000	1000	1150	1850	1140	1575
Specific gravity .	1023	1027	1024	1023	1029	1023	1016	1024	1019
Reaction . .	acid	acid	acid	acid	acid	acid	acid	acid	str'ngly acid
Albumin . .	0	0	0	0	0	0	0	0	0
Indican . . .	moderate	moderate	moderate	strong	present	moderate	moderate	fairly strong	large am'nt
Urea . . .	22.88	20.01	24.13	21.95	26.87	25.6	30.0	30.95	29.86
Urea acid . .	0.634	0.4512	5.541	0.505	0.648	0.688	0.850	9.932	0.8974
Ratio $\frac{\text{urea}}{\text{uric acid}}$.	36.09	44.32	44.6	43.5	41.5	37.2	35.3	33.2	33.0
H_2SO_4 preformed .	2.079	1.726	1.978	1.66	2.06	1.942	2.07	2.61	2.2748
H_2SO_4 combined .	0.162	0.125	0.189	0.148	0.21	0.180	0.226	0.204	0.2622
Ratio $\frac{H_2SO_4\ p}{H_2SO_4\ c}$.	12.8	13.8	10.4	11.2	9.8	10.8	9.16	12.8	8.68
Total N . . .	10.69	9.35	11.27	10.25	12.56	11.96	14.02	14.46	13.95
N of NH_3 grms. .	0.588	0.468	0.650	0.68	0.49	0.49	0.54	0.63	0.8158
N of NH_3 per ct. of total N	5.5	5.0	5.77	6.6	3.9	4.1	3.97	4.3	5.8

The amount of uric acid excreted showed no uniformity in the different specimens. In some cases uric acid was in excess, in others it was in less amount than normal. The average of all the specimens showed a ratio of uric acid to urea of 1:50, or a normal ratio. (See Tables IV. and V.)

In the graver forms of acid intoxication, as in diabetes and certain forms of mania, the acid excretion is in so large quantities that there is a marked increase in the ammonia excretion to neutralize this acid. In the cases of rheumatoid arthritis, however, the percentage of ammonia is not increased, so as to be an indication of a condition of acidosis. The normal percentage of the nitrogen of ammonia is from 2 to 5 per cent. of the total nitrogen. In only twelve of the specimens examined above does it exceed 6 per cent., the average being 5.4. (See Tables IV. and V.)

In reviewing the above records of patients with rheumatoid arthritis, it is found that in all cases with progressive lesions there are certain definite evidences in the urine of perverted metabolism. In only three cases were the stomach contents examined, and in all of these there was absence of free hydrochloric acid after a test meal, although the patients had no other symptoms of gastric indigestion. Intestinal putrefaction was found to be constantly excessive in those patients who had active symptoms of the disease. Besides these evidences of gastric and intestinal disorder there was regularly found in the urine organic acid other than that normally present. As the various forms of organic acid are readily oxidized in the body, the amount formed is probably in excess of the amount excreted.

Patients leading as inactive lives as those with rheumatoid arthritis would naturally be subject to gastrointestinal indigestion, but the regularity with which such symptoms are noted and their degree would suggest that certain of the disturbances of nutrition which occur in rheumatoid arthritis are due to these putrefactive processes in the intestine.

In conclusion, I wish to acknowledge my indebtedness to Dr. Herter in the carrying out of this work. The presence of acidosis in rheumatoid arthritis was first noted by him, and his records of cases are included in the above summary. I wish, also, to express my gratitude to those physicians who placed their patients under observation, especially to Dr. V. P. Gibney, Dr. A. Lambert, and Dr. C. A. Ransom.

THE DIAGNOSTIC VALUE OF LEUKOCYTOSIS.[1]

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The remarkably large fluctuation in the number of leukocytes circulating in the peripheral blood constitutes one of the most intensely interesting of hæmatological phenomena. The relationship

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[1] Read before the Indiana State Medical Society, May, 1904.